
CASPER DRAFT
RESOURCE MANAGEMENT PLAN AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX V

Economic Impact Analysis Methodology

Appendix V

Economic Impact Analysis Methodology

This appendix describes the detailed data used in the economic impact modeling analysis. Input-output models such as the Impact Analysis for Planning (IMPLAN) model, an economic impact analysis model, provide a quantitative representation of the production relationships between individual economic sectors. Thus, the economic modeling analysis uses information about physical production quantities and the prices and costs for goods and services. The inputs required to run the IMPLAN model are described in the following narrative and tables. The resulting estimates from the IMPLAN model, by alternative, can be found in the Economic Conditions section in Chapter 4. The first section, below, provides details of how the IMPLAN model was used to estimate economic impacts. The remaining sections provide additional detailed data used in the analysis for oil and gas, coal, livestock grazing, and recreation.

1.0 THE IMPLAN MODEL

IMPLAN is a regional economic model that provides a mathematical accounting of the flow of money, goods, and services through a region's economy. The model provides estimates of how a specific economic activity translates into jobs and income for the region. It includes the ripple effect (also called the "multiplier effect") of changes in economic sectors that may not be directly impacted by management actions, but are linked to industries that are directly impacted. In IMPLAN, these ripple effects are termed indirect impacts (for changes in industries that sell inputs to the industries that are directly impacted) and induced impacts (for changes in household spending as household income increases or decreases due to the changes in production).

This analysis involved direct changes in economic activity for 11 of the 528 IMPLAN economic sectors (as well as changes in all other related sectors due to the ripple effect). Three of these 11 sectors are related to oil, gas, and coal production (e.g., Natural Gas and Crude Petroleum, Maintenance and Repair of Oil and Gas Wells, and Coal Mining). Two sectors are related to livestock production (Ranch Cattle, and Sheep, Lambs, and Goats). Six sectors are related to off-highway vehicle (OHV) and recreation: Hotels and Lodging Places, Eating and Drinking, Amusement and Recreation Services, Food Stores, Service Stations, and Miscellaneous Retail.

The IMPLAN production coefficients were modified to reflect the interaction of producing sectors in the study area. As a result, the calibrated model does a better job of generating multipliers and the subsequent impacts that reflect the interaction between and among the sectors in the study area compared to a model using unadjusted national coefficients. Specifically, worker productivity in oil and gas production is higher in Wyoming than nationally, and more of the hay used for livestock feed is produced within the region, compared with national averages. Key variables used in the IMPLAN model were filled in using data specific to Wyoming, including employment estimates, labor earnings, and total industry output (Taylor 2004). Due to price fluctuations, the value of cattle and sheep production were based on the average value from 1993 to 2002, calculated based on data from the Wyoming Agricultural Statistics Service (Taylor 2004). This analysis used IMPLAN 2000; prior to running the model, cost and price data were converted to a consistent dollar year (2000) using regional and sector-specific adjustment factors from the model. Though the values in this appendix generally are expressed in year 2000 dollars, model outputs were converted to 2003 dollars for comparison with the 2003 income estimates in Chapter 3.

2.0 OIL AND GAS

The economic impacts analysis for oil and gas reflects drilling, completion, and production activities.

The Minerals – Leasable section in Chapter 4 provides information on the number of oil and gas wells drilled, number of wells completed (i.e., productive wells), and oil and gas production on Bureau of Land Management (BLM)-administered land and mineral estate from 2001 to 2020 in the planning area. The costs of drilling and completing wells and producing oil and gas, also are relevant for the economic impact analysis.

Table V-1 provides a summary of the assumptions used for the economic analysis relative to the costs of drilling, completion, and production of conventional wells in the Wind River Basin, the Powder River Basin, and Salt Creek, as well as for coalbed natural gas wells.

Table V-1. Assumptions for Analysis of Economic Impacts for Oil and Gas Well Drilling and Completion According to Well Type

Assumption	Conventional Wells			Coalbed Natural Gas Wells
	Wind River Basin	Powder River Basin	Salt Creek	
Drilling Impacts				
Drilling Cost (\$/well)	\$542,123	\$621,183	\$103,672	\$42,400
Local Drilling Costs ¹	99%	100%	89%	82%
Local Direct Impact (\$/well)	\$536,702	\$621,183	\$92,268	\$34,768
Local Total Impact (\$/well) ²	\$789,067	\$913,273	\$135,564	\$51,117
Multiplier (total impact/direct impact)	1.47	1.47	1.47	1.47
Completion Impacts				
Completion Cost (\$/well)	\$1,106,922	\$624,924	\$53,947	\$57,711
Local Completion Costs ¹	76%	37%	38%	86%
Local Direct Impact (\$/well)	\$772,861	\$231,222	\$20,500	\$49,631
Local Total Impact (\$/well) ²	\$1,117,881	\$334,444	\$29,651	\$71,788
Multiplier (total impact/direct impact)	1.45	1.45	1.45	1.45
Completion Rate (% of completed wells drilled)	77%	80%	99%	98%

Source: Data on drilling and completion costs, completion rate, and local drilling and completion costs were taken from Stilwell (2004) and converted from 2003 to 2000 dollars using IMPLAN adjustment factors.

¹ The local cost shares were based on the percent of total drilling or completion costs that would be spent on goods and services purchased from the local economy.

² Total impacts estimated using IMPLAN include direct, indirect, and induced impacts.

The assumptions in Table V-2 were used to determine the values of natural gas and oil production. In addition, the analysis used a figure of \$0.89 (year 2000 dollars) per thousand cubic feet (mcf) for gas production costs based on data from the Energy Information Administration (Taylor 2004).

Table V-2. Assumptions for Analysis of Economic Impacts on Output for Oil and Gas Production

Economic Impact	Oil Production (per million barrels)	Gas Production (per billion cubic feet)
Direct Economic Impact ¹	\$29,070,000 ²	\$4,120,000 ³
Indirect Economic Impact ⁴	\$ 4,197,650	\$594,920
Induced Economic Impact ⁵	\$688,930	\$97,640
Total Economic Impact	\$33,956,580	\$4,812,560
Multiplier (total impact/direct impact)	1.17	1.17

Note: All dollar values are in 2000 dollars.

¹ Direct economic impact is the market value of output.

² Based on oil price forecast of \$30 per barrel for beyond 2005 (CREG 2005), converted to 2000 dollars using IMPLAN adjustment factors.

³ Based on natural gas price forecast of \$4.25 per thousand cubic feet for beyond 2005 (CREG 2005) converted to 2000 dollars using IMPLAN adjustment factors.

⁴ Indirect impacts from IMPLAN reflect increased demand in sectors that directly or indirectly provide supplies to the oil and gas industry.

⁵ Induced impacts from IMPLAN reflect increased demand in the consumer and government sectors.

The forecasted number of wells and production used for estimating employment impacts is the same as for estimating impacts on labor earnings and output. Table V-3 shows the direct and total employment impacts attributable to drilling and completion. Table V-4 shows the direct and total employment impacts associated with production.

Table V-3. Assumptions for Employment Impact Analysis for Oil and Gas Well Drilling and Completion According to Well Type

Employment Impact	Conventional Wells			Coalbed Natural Gas Wells
	Wind River Basin	Powder River Basin	Salt Creek	
Drilling Impacts				
Direct Employment (jobs/well)	4.6	5.3	0.8	0.3
Total Employment Impact (jobs/well)	8.2	9.4	1.4	0.5
Multiplier (Total Impact/Direct Impact)	1.77	1.77	1.77	1.77
Average Earnings per Job (2000 dollars)	\$38,358	\$38,358	\$38,358	\$38,358
Average Earnings per Job (2003 dollars)	\$39,126	\$39,126	\$39,126	\$39,126
Completion Impacts				
Direct Employment (jobs/well)	8.2	2.5	0.2	0.5
Total Employment Impact (jobs/well)	13.1	3.9	0.3	0.8
Multiplier (Total Impact/Direct Impact)	1.59	1.59	1.59	1.59
Average Earnings per Job (2000 dollars)	\$34,402	\$34,402	\$34,402	\$34,402
Average Earnings per Job (2003 dollars)	\$35,090	\$35,090	\$35,090	\$35,090

Note: Direct and total employment impact and average earnings per job are calculated using IMPLAN.

Table V-4. Assumptions for Employment Impacts Analysis for Oil and Gas Production

Employment Impact (annual number of jobs)	Oil Production (per million barrels)	Gas Production (per billion cubic feet)
Direct Employment	4.2	0.7
Indirect Employment	21.0	3.5
Induced Employment	8.4	1.4
Total Employment	33.6	5.6
Multiplier (Total Impact/Direct Impact)	8.00	8.00
Average Earnings per Job (2000 dollars)	\$38,666	\$38,666
Average Earnings per Job (2003 dollars)	\$39,440	\$39,440

Note: Direct, indirect, and induced employment impact and average earnings per job are calculated using IMPLAN.

The analysis of potential changes in tax revenues is based on tax rates of 12.5 percent of taxable value for federal mineral royalties, 6 percent of taxable value for state severance taxes (WY DOR 2001), and 6.3 percent of taxable value for local ad valorem production taxes (based on averaging local mineral tax rates for Converse County and Natrona County from WY DOR (2005), and reported in the Economic Conditions section of Chapter 3). Taxable value refers to value of sales minus allowable deductions, including certain costs of production and transportation. For analysis purposes, taxable value was estimated based on the average taxable value per unit sold from Natrona and Converse Counties for July 2003 through June 2004 using data from WY DOR (2005). Taxable value was estimated as \$27.06 per barrel for oil, and \$3.74 per mcf for natural gas (2003 dollars).

3.0 COAL

Although the alternatives being considered would affect coal exploration and leasing, the focus of the quantitative economic analysis in terms of coal mining is on the production from the Antelope Mine, which is located partially in Converse County and partially in Campbell County (outside the planning area). The production of coal from this mine and the proportion from Converse County are not expected to vary by alternative; however, the economic impacts associated with coal production were analyzed in the IMPLAN model because of the relative economic importance of coal in the planning area.

For coal production, the Casper Solid Minerals Group at BLM provided expenditure data on the cost of coal production that ranged from a low of \$4.67 per ton in 2004 to \$5.74 per ton in 2020 (BLM 2005). These data were based on estimated future overburden and other factors (Wright 2004). Economic impacts were based on price data from the Consensus Revenue Estimating Group (CREG 2004). Consistent with the Powder River Basin Coal Environmental Impact Statement (EIS), the coal price was adjusted over time using a 1 percent annual increase in real price, which is also the trend present in the price data from CREG (2004). The BLM used coal production estimates consistent with the Powder River Basin Coal EIS that range from 29.7 million tons in 2004 to 32 million tons in 2020 based on the likely output of the Antelope Mine, which is located partially in Converse County (Karbs 2004, BLM 2005). The share of the production from Converse County, which is expected to vary over the life of the Resource Management Plan (RMP), was used to derive the share of local income. The estimated share of production from Converse County is 85 percent in 2004 and 2005, 10 percent in 2010, 60 percent in 2015, and 100 percent in 2020 (BLM 2005); the percentage from Converse County is expected to vary over time because the locations of primary production shift back and forth across county lines as coal production continues.

The estimates of employment impact associated with coal production use the same assumptions for production and cost of production as the analysis of impacts on output and labor earnings (i.e., the assumptions in the paragraph immediately above: production estimates ranging from 29.7 million tons in 2004 to 32 million tons in 2020 for the Antelope Mine, adjusted for the share of production from Converse County, and a cost of production ranging from \$4.67 per ton in 2004 to \$5.74 per ton in 2020). For every \$1 million in additional economic output due to coal production, IMPLAN projects between 5.3 and 5.5 additional jobs (1.9 to 2.2 from direct activity and 3.3 to 3.4 from indirect and induced economic activity; the variation is due to multiple runs of IMPLAN that represent different scenarios with respect to price, cost, and labor productivity). Average earnings per job range from \$66,149 to \$72,473 (2003 dollars); again, the variation is attributable to different IMPLAN runs with different assumptions regarding price, cost, and labor productivity.

4.0 LIVESTOCK GRAZING

Economic impacts due to changes in livestock grazing are a function of the amount of forage available and the economic value of the forage. For livestock grazing, long-term surface-disturbing actions from actions listed in Appendix M could affect the authorized animal unit months (AUMs). In addition, land disposal actions could have economic impacts; however, those impacts were not analyzed quantitatively because it is difficult to predict the net change in AUMs. Subsequent landowners may continue to graze the land, leaving overall livestock production and output in the region unaffected.

Table V-5 provides a summary, according to alternatives, of initial AUMs and total AUMs lost by 2020 due to surface-disturbing activities. Based on current animal inventory levels from the Wyoming Agricultural Statistics Yearbook (Wyoming Agricultural Statistics Service 2003) and factoring in forage requirements that vary by species (BLM 2004), 95 percent of the AUM reduction is allocated to cattle and 5 percent to sheep (for the purpose of estimating changes in output and employment).¹ The base number of AUMs available was 182,789 (Fifield 2004). Surface-disturbance acres were converted to AUMs using a conversion factor of 7.5 acres per AUM (Fifield 2004).

Table V-5. Estimated Animal Unit Month Losses

Item	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Initial AUMs	182,789	182,789	182,789	182,789	182,789
AUMs lost from surface-disturbing activities (total)	2,812	1,542	2,714	2,944	2,890
AUMs lost from surface-disturbing activities (per year)	141	77	136	147	144
Net AUMs in 2020	179,977	181,247	180,075	179,845	179,899

Note: Acres are converted to AUMs using a conversion factor of 7.5 acres per AUM (Fifield 2004).

Due to price fluctuations, average per-AUM values for cattle and sheep are based on the 1993 to 2002 average value of production estimates from the Wyoming Agricultural Statistics Service (Taylor 2004). The value for cattle is \$35.25 per AUM and the value for sheep is \$22.89 per AUM (in 2000 dollars). Including indirect and induced impacts, the value of one AUM for cattle is \$66.12 and for sheep \$38.01 (in 2000 dollars). Table V-6 shows the economic impact assumptions for cattle and sheep. The direct

¹ In some years, actual use of grazing leases may be less than 100 percent of authorized use. If surface disturbance impacts land that is authorized for grazing, but not actually used in a given year, then no economic impacts would result from the loss of that grazing land. However, almost none of the grazing lease holders in the planning area apply for nonuse refunds, which implies that the level of use is close to 100 percent of authorized use in most years (Fifield 2006). For the purposes of analysis, grazing economic impacts are based on actual use being 100 percent of authorized use.

economic impact is the estimated change in livestock output per AUM; IMPLAN generates the indirect and induced impacts.

Table V-6. Assumptions for Analysis of Impacts on Output for Livestock Grazing

Economic Impact	Cattle	Sheep
Direct Economic Impact (\$/AUM) ¹	\$35.25 ²	\$22.89
Indirect Economic Impact (\$/AUM) ³	\$22.02	\$10.00
Induced Economic Impact (\$/AUM) ⁴	\$8.85	\$5.12
Total Economic Impact (\$/AUM)	\$66.12	\$38.01
Multiplier (Total Impact/Direct Impact)	1.88	1.66

Note: All dollar values are in 2000 dollars.

¹ Direct economic impact is the market value of output.

² Price is based on data for 1993-2002 from Wyoming Agricultural Statistics Service (Taylor 2004).

³ Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the livestock industry.

⁴ Induced impacts reflect increased demand in the consumer and government sectors.

AUM Animal Unit Months

Table V-7 provides a summary of the employment impacts assumed according to unit changes in livestock AUMs.

Table V-7. Assumptions for Analysis of Employment Impacts for Livestock Grazing

Employment Impact	Cattle	Sheep
Direct Employment (Jobs/1,000 AUMs)	0.311	0.705
Indirect Employment (Jobs/1,000 AUMs)	0.275	0.167
Induced Employment (Jobs/1,000 AUMs)	0.141	0.082
Total Employment (Jobs/1,000 AUMs)	0.727	0.955
Multiplier (Total Impact/Direct Impact)	2.34	1.35
Average Earnings per Job (2000 dollars)	\$27,180	\$12,524
Average Earnings per Job (2003 dollars)	\$28,158	\$12,975

Note: Direct, indirect, and induced employment impacts and average earnings per job are calculated using IMPLAN.

5.0 RECREATION

The analysis of economic impacts considers only recreation expenditures of nonresidents of the four-county study area. This is based on the assumption that expenditures of residents would occur in the region regardless of the BLM's actions that impact recreational opportunities; however, changes in nonresident recreation patterns would alter the amount of money entering the local region.

Economic impacts from recreation are a function of recreation visitor days (RVDs) and expenditures per day. Future RVDs were estimated based on current RVDs and estimated growth rates. Current RVDs were estimated using RVDs in 2002 from the Wyoming Game and Fish Department (WGFD) (Burkett 2004) for hunting and fishing, and RVDs in 2002 from BLM (Bennett 2004) for OHV and other nonconsumptive recreation (also called dispersed recreation; this category includes, but is not limited to, heritage tourism, hiking, viewing wildlife, biking and horseback riding). Nonresident RVDs in 2002 were estimated at 26,250 for OHV, 28,872 for hunting, 112,399 for fishing, and 29,200 for other nonconsumptive recreation.

Annual growth rates for nonresident RVDs under Alternative A were estimated using a U.S. Forest Service study that provides forecasts of recreation activity for the Rocky Mountain region (Bowker et al.

1999). Annual growth rates for nonresident RVDs under Alternatives B through E were estimated based on the same study (Bowker et al. 1999), but modified by taking into account the impacts of the alternatives with respect to nonresident recreation patterns (Bennett 2004). Table V-8 provides a summary of estimated annual growth rates by alternative.

Table V-8. Estimated Annual Growth Rates for Nonresident Recreation Visitor Days

Recreation Activity	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
OHV	0.7%	0.1%	0.1%	0.4%	0.1%
Hunting	0.5%	1.3%	0.8%	0.5%	1.3%
Fishing	1.0%	0.8%	0.8%	0.8%	0.8%
Other Nonconsumptive	1.5%	3.8%	3.8%	0.9%	0.9%

Source: Based on Bowker et al. 1999 and Bennett 2004, as discussed in text.

% Percent

OHV Off-highway vehicle

The estimates for average expenditure per visitor day are \$94.03 for fishing in 2002 dollars (WGFD 2003); \$179.63 for hunting in 2002 dollars (Burkett 2004); \$51.55 for wildlife watching in 2001 dollars (USFWS 2003; expenditures excluding equipment costs); and \$130.60 for OHV use in 2000 dollars (Colorado OHV Coalition 2001). These expenditures were converted to 2000 dollars to facilitate comparison and because the IMPLAN 2000 model uses year 2000 dollars. Table V-9 shows the direct, indirect, and induced output per RVD for each recreation activity.

Table V-9. Assumptions for Analysis of Impacts on Output for Recreation Activities

Economic Impact	OHV (per RVD)	Hunting (per RVD)	Fishing (per RVD)	Other (per RVD)
Direct Economic Impact ¹	\$130.60	\$170.78	\$89.75	\$50.36
Indirect Economic Impact ²	\$24.81	\$39.36	\$12.10	\$6.98
Induced Economic Impact ³	\$19.44	\$31.91	\$13.48	\$6.93
Total Economic Impact	\$174.85	\$242.05	\$115.34	\$64.27
Multiplier (total impact/direct impact)	1.34	1.42	1.28	1.28

Note: Detail may not add to total due to rounding. All dollar values are in 2000 dollars.

¹ Direct economic impact is the average expenditure per visitor day.

² Indirect impacts from IMPLAN reflect increased demand in sectors that directly or indirectly provide support for the recreation industry.

³ Induced impacts from IMPLAN reflect increased demand in the consumer and government sectors.

IMPLAN Impact Analysis for Planning

OHV Off-highway vehicle

RVD Recreation visitor day

Table V-10 provides a summary of employment impacts assumed according to unit changes in RVDs.

Table V-10. Assumptions for Employment Impacts Analysis for Recreation Activities

Employment Impact (annual number of jobs)	OHV (per RVD)	Hunting (per RVD)	Fishing (per RVD)	Other (per RVD)
Direct Employment	0.002468	0.006071	0.001748	0.000856
Indirect Employment	0.000392	0.000521	0.000169	0.000113
Induced Employment	0.000313	0.000503	0.000216	0.000113
Total Employment	0.003174	0.007095	0.002134	0.001083
Multiplier (Total Impact/Direct Impact)	1.29	1.17	1.22	1.27
Average Earnings per Job (2000 dollars)	\$14,568	\$10,596	\$15,050	\$15,234
Average Earnings per Job (2003 dollars)	\$15,660	\$11,390	\$16,118	\$16,286

Note: Average earnings per job are in 2000 dollars.

Direct, indirect, and induced employment impact and average earnings per job are calculated using IMPLAN.

IMPLAN Impact Analysis for Planning

OHV Off-highway vehicle

RVD Recreation visitor day

6.0 REFERENCES

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